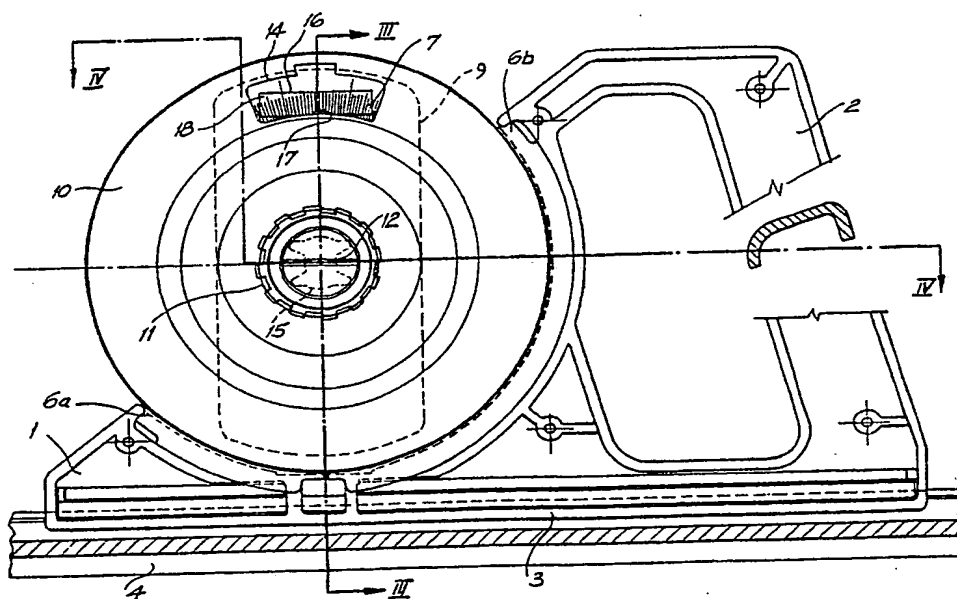




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: SLOPE INDICATING DEVICE



## (57) Abstract

A slope indicating device or 'level' having an arcuate angle indicating scale (7) arrayed about a central axis (12) of reference member (1) having a straight edge (3) adapted to be aligned with a slope. A bubble tube (16) is located against the angle indicating scale (7) on a level indicating member (9) rotatably mounted on the reference member (1) about central axis (12) so that the bubble tube may always be aligned and/or read against or adjacent the angle indicating scale. In the preferred embodiment the arcuate angle indicating scale is on a transparent toroid (5) which surrounds the bubble tube (16), and an annular housing member (10) is provided, encasing the toroid, keyed to and rotating with the level indicating member, and provided with a viewing window (14) aligned with the bubble tube (16).

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"SLOPE INDICATING DEVICE"TECHNICAL FIELD

This invention relates to a slope indicating device and has been devised particularly though not solely for the simple and accurate determination of verticals, horizontals, 5 inclines and slopes, particularly for use in the building industry or the like.

BACKGROUND ART

In building operations it has been well known to use a 10 "level" (often referred to as a spirit level) to check for precise vertical and horizontal directions. Such levels normally incorporate one or more bubble tubes and it is to be understood throughout this specification that the term "bubble tube" relates to the small often slightly arcuate 15 tube of the type used in conventional or prior art spirit levels. Similarly, although the term "bubble" has been used throughout this specification it is to be understood that a "bubble tube" may similarly incorporate any other form of buoyant indicator such as a small marker of buoyant plastics 20 material. The term "bubble" is defined as including all such buoyant indicators.

It is a disadvantage of the common type of prior art level that it may not readily be used to determine slopes having other than true horizontal or vertical directions. 25 Various attempts have been made in the past to provide a level which will enable slopes other than vertical or horizontal directions to be accurately determined, but such levels have been difficult to use or read, and furthermore are fragile in use and prone to errors if the levels are 30 knocked or dropped.

It is therefore an object of the present invention to provide a slope indicating device which will obviate or minimise the foregoing disadvantages in a simple yet effective manner, or which will at least provide the public 35 with a useful choice.

DISCLOSURE OF THE INVENTION

Accordingly in one aspect the invention consists in a



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slope indicating device comprising a reference member adapted to be aligned with the slope to be indicated, an arcuate angle indicating scale arrayed about a central axis and fixedly located relative to said reference member, and a  
5 level indicating member rotatably mounted to said reference member about the central axis of said arcuate scale, said level indicating member incorporating a bubble tube (as herein defined) positioned such that the level indicating member may be rotated about the central axis until the  
10 bubble tube is substantially horizontal, whereupon the bubble therein may be viewed against or adjacent the angle indicating scale.

In the preferred form of the invention the arcuate angle indicating scale comprises a  $360^{\circ}$  scale forming a complete  
15 circle about the central axis. The arcuate angle indicating scale is marked or otherwise indicated on a substantially transparent toroidal member having its axis coincident with said central axis, and having an open circumferential slit around the inner periphery thereof, and wherein said level  
20 indicating member comprises a plate-like member having its outer edges extending through said slit into the toroid of said angle indicating scale, and wherein said bubble tube is positioned within said toroid with its elongate direction aligned tangentially relative to the toroid.

25 Further protection for the slope indicating device may also be obtained by the provision of a housing member which is also adapted to assist in the accurate reading of the position of the bubble against the angle indicating scale. The housing member is provided in the form of an annulus  
30 surrounding and substantially encasing the toroidal member, said housing member being fastened to said level indicating member at a central hub about said central axis so as to be rotatable therewith, said housing member incorporating a viewing window therein aligned with the position of said  
35 bubble tube on said level indicating member. To assist in the accurate reading of the slope indicating device the viewing window incorporates cursor markings alignable with

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the bubble within said tube, and a central marking adapted to be read off against said arcuate indicating scale, enabling the position of the bubble to be accurately determined against the scale.

- 5 In a further aspect the invention consists in a slope indicating device comprising a reference member adapted to be aligned with the slope to be indicated, an arcuate angle indicating scale arrayed about a central axis and fixedly located relative to said reference member and a
- 10 substantially transparent toroidal tube having its axis coincident with said central axis, said tube being filled with liquid having a buoyant indicator therein arrayed so that the position of the buoyant indicator may be viewed against or adjacent the angle indicating scale.
- 15 Once again in the preferred form of the invention the slope indicating device is provided with a housing member in the form of an annulus surrounding and substantially encasing the toroidal tube and being rotatable about the central axis, said housing member incorporating a viewing
- 20 window therein which may be aligned with the position of the buoyant indicator within the tube.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- Notwithstanding any other forms that may fall within its scope, one preferred form of the invention will now be
- 25 described by way of example only with reference to the accompanying drawings, in which:-

Fig. 1 is a general perspective view of a slope indicating device according to the invention;

- Fig. 2 is a side view of the slope indicating device
- 30 shown in Fig. 1, with the reference member and handle portion thereof shown in cross-section;

Fig. 3 is a vertical cross-section on the line III-III of Fig. 2;

- Fig. 4 is a broken horizontal section on the line IV-IV
- 35 of Fig. 2;

Fig. 5 is a side view of an alternative configuration of the slope indicating device according to the invention; and

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Fig. 6 is a plan view of the embodiment shown in Fig. 5.

MODES FOR CARRYING OUT THE INVENTION

In the preferred form of the invention the slope indicating device comprises a basic frame or reference member 1 preferably moulded from a high impact plastics material and incorporating a convenient handle 2. The reference member is provided with a straight edge foot 3 which may be placed against the slope to be measured or indicated. In the preferred form of the invention the foot 3 is flanged as shown in Fig. 3 so that it may be readily engaged with an elongate straight edge 4 which is typically an aluminium extrusion. In alternative forms of the invention the foot 3 may be provided with a clip so that the slope indicating device may be coupled to any other elongate member such as a conventional spirit level.

The slope indicating device is provided with an arcuate angle indicating scale which in the preferred form of the invention comprises a toroid 5 of a transparent material such as a clear plastics material which is secured to the reference member at least at its lower point 6 and preferably around the perimeter from 6a to 6b. The toroid is provided with an angle indicating scale 7 around its periphery, normally graduated into  $360^{\circ}$  graduations, both the toroid and the scale being arrayed about a central axis 12. The toroid is provided with a circumferential slit opening 8 around the internal periphery of the toroid, through which is inserted a plate-like level indicating member 9 as described further below.

The slope indicating device is provided with a housing member 10 preferably moulded from high impact plastics material and manufactured in two halves which are joined together to form a central knob 11 and a peripheral annular portion which engages and slides over the arcuate angle indicating scale toroid 5 so that the housing member is rotatable about the central axis 12. Rotation of the housing member is achieved by the operator by grasping and rotating the knob 11 which may conveniently be milled on its

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outer face 13. The housing member is provided with a window or opening 14 through which a portion of the angle indicating scale 7 may be read.

5 The slope indicating device further incorporates a plate-like level indicating member 9 (shown in broken outline in Fig. 1) which is keyed or otherwise fastened to the hub 11 at the central point 15 so as to be rotatable with the housing member. The level indicating member is provided with a conventional bubble tube 16 inserted into  
10 the indicating member and located in a position corresponding with the viewing window 14 in the housing member. Either the housing member or the level indicating member is conveniently provided with a central marking in the form of a pointer 17 which may be read off against the  
15 angle indicating scale to indicate the relative rotation of the housing member, and hence the level indicating member, relative to the reference member 1. The bubble tube 16 (or the window in the housing) may also be provided with convenient cursor lines to enable the location of the bubble  
20 18 to be accurately determined relative to the centre point of the bubble tube and the indicating pointer 17.

In use when it is desired to determine the slope of an edge or surface, the straight edge 4 is placed along that edge so that the surface 3 of the reference member 1 is  
25 aligned with and parallel to the edge whose slope is to be measured. The housing member and level indicating member are then rotated by turning the central knob 11 until the window 14 is in an uppermost position whereupon the bubble 18 in the bubble tube 16 may be viewed through the window.  
30 The knob 11 may then be carefully rotated to centralise the bubble 18 between the cursor lines of the bubble tube or relative to the indicating pointer 17 whereupon the angle of inclination of the slope may be read off by the pointer 17 against the angle indicating scale 7. In this manner the  
35 inclination of a slope may be simply and accurately determined and simply read by viewing the bubble in the bubble tube directly against the angle indicating scale 7.

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It is a feature of the invention that the alignment of the bubble within the bubble tube and the reading of the angle indicating scale take place in the same visual location which considerably simplifies operation of the slope indicating device.

The slope indicating device may also be used to set up a desired slope or inclination by pre-setting the pointer 17 to the desired position against the angle indicating scale 7 and then orientating the device until the bubble in the bubble tube is synchronised either against the pointer 17 or between the cursor lines on the bubble tube. The foot 3 of the reference member 1 will then be at the pre-set inclination.

In an alternative embodiment of the invention as shown in Figs 5 and 6 the level indicating member and bubble tube mounted thereon are disposed with and the toroid is enclosed and filled with liquid having a buoyant indicator therein. Reference will now be made to Figs. 5 and 6 in which similar numbers describe similar features as previously described with reference to Figs. 2 to 4. In this configuration the annular portion of the toroid 20 is fully enclosed to form a large scale  $360^{\circ}$  spirit level tube 20 filled with liquid except for a buoyant indicator in the form of a bubble 21. In this form of the invention the housing member 10 is once again rotated by the knob 11 until the window 14 is aligned with the bubble 21. The upper part of the window 14 may conveniently be cut away to provide cursor marks or edges 22 for accurate location of the bubble whose exact orientation can be read off by the pointer 17 against the arcuate scale 7.

In this manner a slope indicating device is provided which enables a slope of any inclination to be rapidly and accurately determined. Furthermore the construction of the device is such that it is extremely robust in use and able to take severe abuse without losing accuracy. It is a particular feature of the invention that the bubble tube 16 is located within both the angle indicating scale toroid and



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also the housing member 10 which gives a considerable degree of protection both to the bubble tube itself and to its mounting within the device.

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CLAIMS

1. A slope indicating device comprising a reference member adapted to be aligned with the slope to be indicated, an arcuate angle indicating scale arrayed about a central axis and fixedly located relative to said reference member, and a level indicating member rotatably mounted to said reference member about the central axis of said arcuate scale, said level indicating member incorporating a bubble tube (as herein defined) positioned such that the level indicating member may be rotated about the central axis until the bubble tube is substantially horizontal, whereupon the bubble therein may be viewed against or adjacent the angle indicating scale.

2. A slope indicating device as claimed in claim 1, wherein said arcuate angle indicating scale comprises a  $360^{\circ}$  scale forming a complete circle about said central axis.

3. A slope indicating device as claimed in claim 1, wherein said arcuate angle indicating scale is marked or otherwise indicated on a substantially transparent toroidal member having its axis coincident with said central axis, and having an open circumferential slit around the inner periphery thereof, and wherein said level indicating member comprises a plate-like member having its outer edges extending through said slit into the toroid of said angle indicating scale, and wherein said bubble tube is positioned within said toroid with its elongate direction aligned tangentially relative to the toroid.

4. A slope indicating device as claimed in claim 3, wherein a housing member is provided in the form of an annulus surrounding and substantially encasing the toroidal member, said housing member being fastened to said level indicating member at a central hub about said central axis so as to be rotatable therewith, said housing member incorporating a viewing window therein aligned with the position of said bubble tube on said level indicating member.

5. A slope indicating device as claimed in claim 4,



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wherein either the viewing window or the bubble tube incorporate cursor markings alignable with the bubble within said tube, and a central marking adapted to be read off against said arcuate indicating scale, enabling the position of the bubble to be accurately determined against the scale.

6. A slope indicating device comprising a reference member adapted to be aligned with the slope to be indicated, an arcuate angle indicating scale arrayed about a central axis and fixedly located relative to said reference member and a substantially transparent toroidal tube having its axis coincident with said central axis, said tube being filled with liquid having a buoyant indicator therein arrayed so that the position of the buoyant indicator may be viewed against or adjacent the angle indicating scale.

7. A slope indicating device as claimed in claim 6, wherein said buoyant indicator comprises a bubble in the liquid contained within the toroidal tube.

8. A slope indicating device as claimed in claim 6, wherein said arcuate angle indicating scale comprises a 360° scale arrayed around said toroidal tube.

9. A slope indicating device as claimed in claim 6, wherein a housing member is provided in the form of an annulus surrounding and substantially encasing the toroidal tube and being rotatable about the central axis, said housing member incorporating a viewing window therein which may be aligned with the position of the buoyant indicator within the tube.

10. A slope indicating device as claimed in claim 9, wherein said housing member comprises a pair of shell-like cover elements rotatably mounted on a hub concentrically disposed with said central axis.

11. A slope indicating device as claimed in claim 9, wherein said viewing window incorporates cursor markings alignable with the bubble within said tube, and a central marking adapted to be read off against said arcuate indicating scale, enabling the position of the bubble to be accurately determined against the scale.

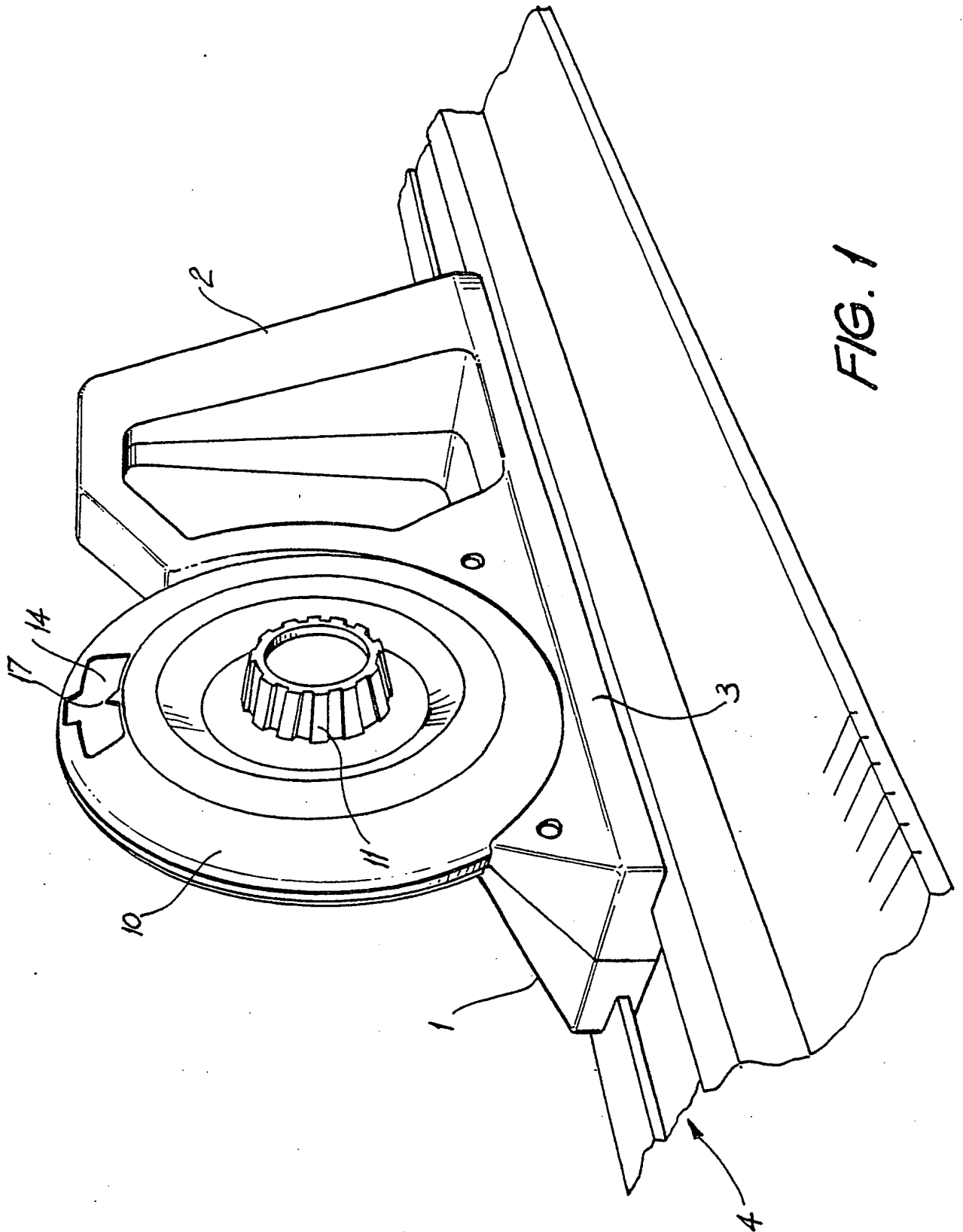
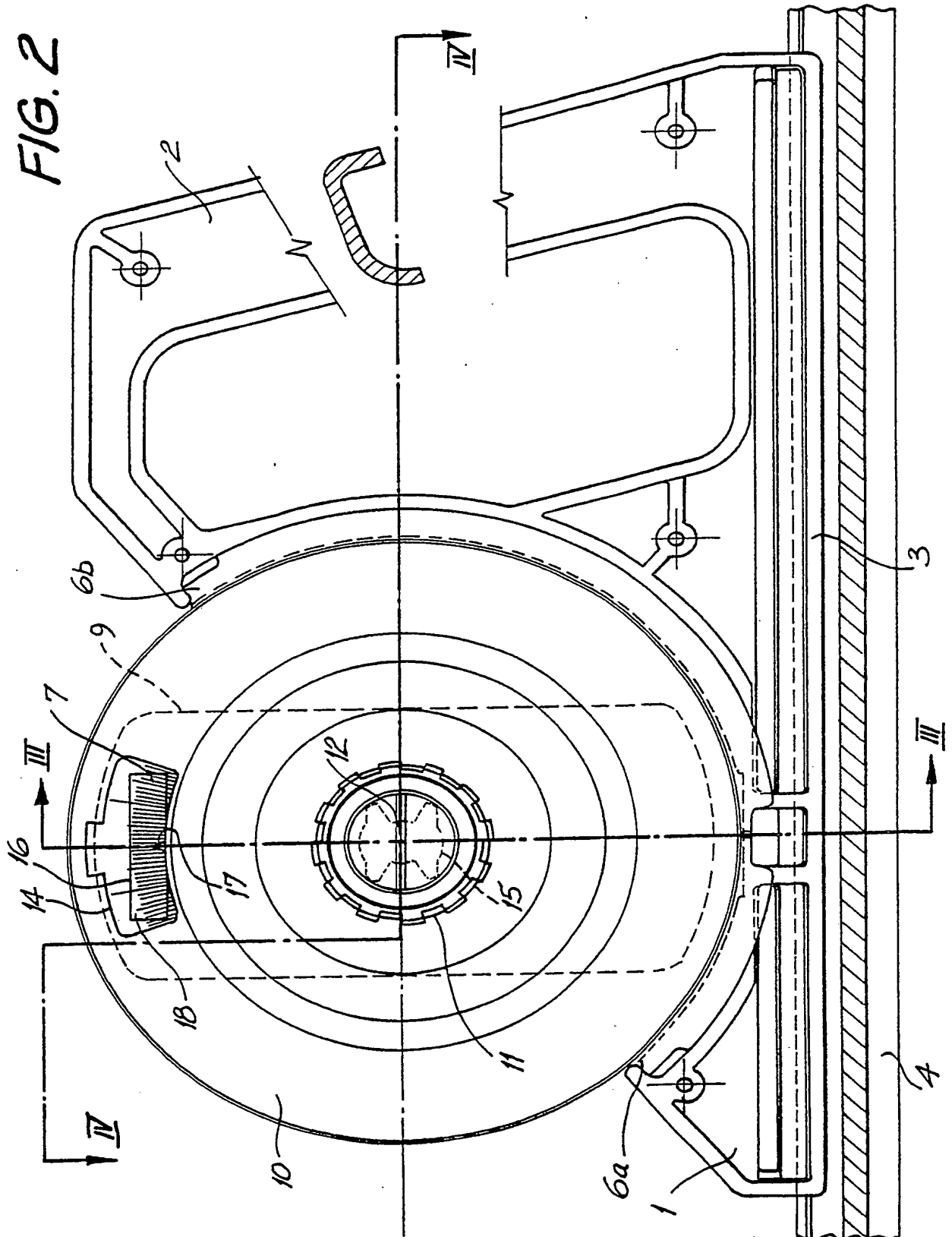


FIG. 2



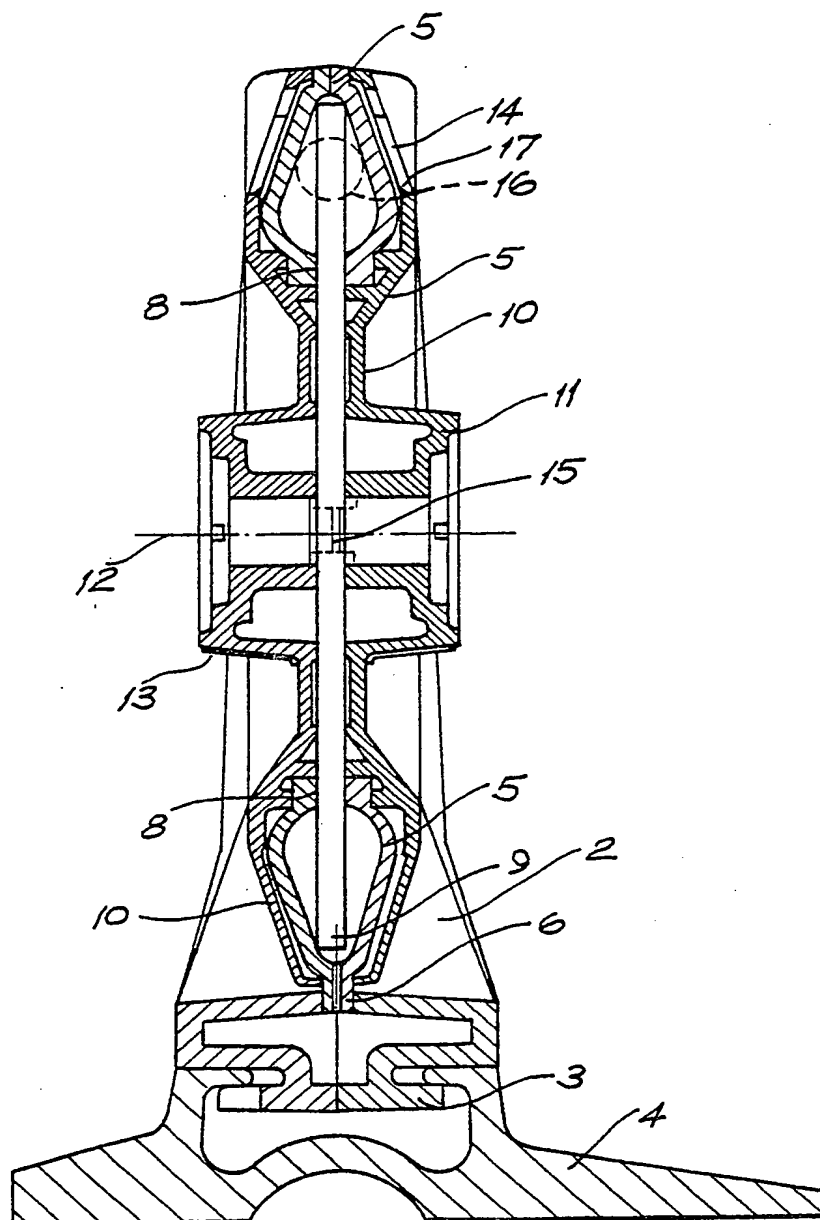
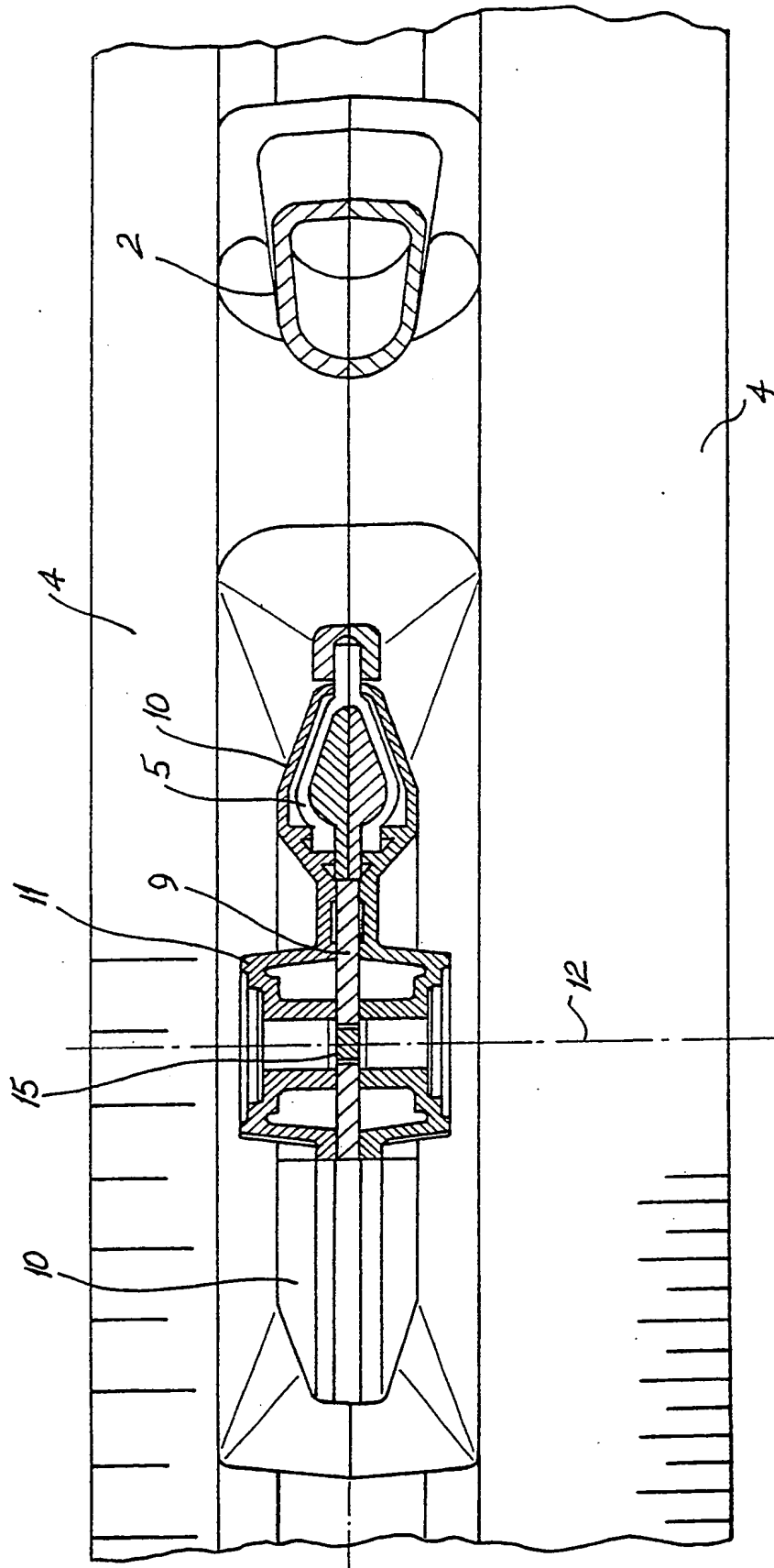


FIG. 3



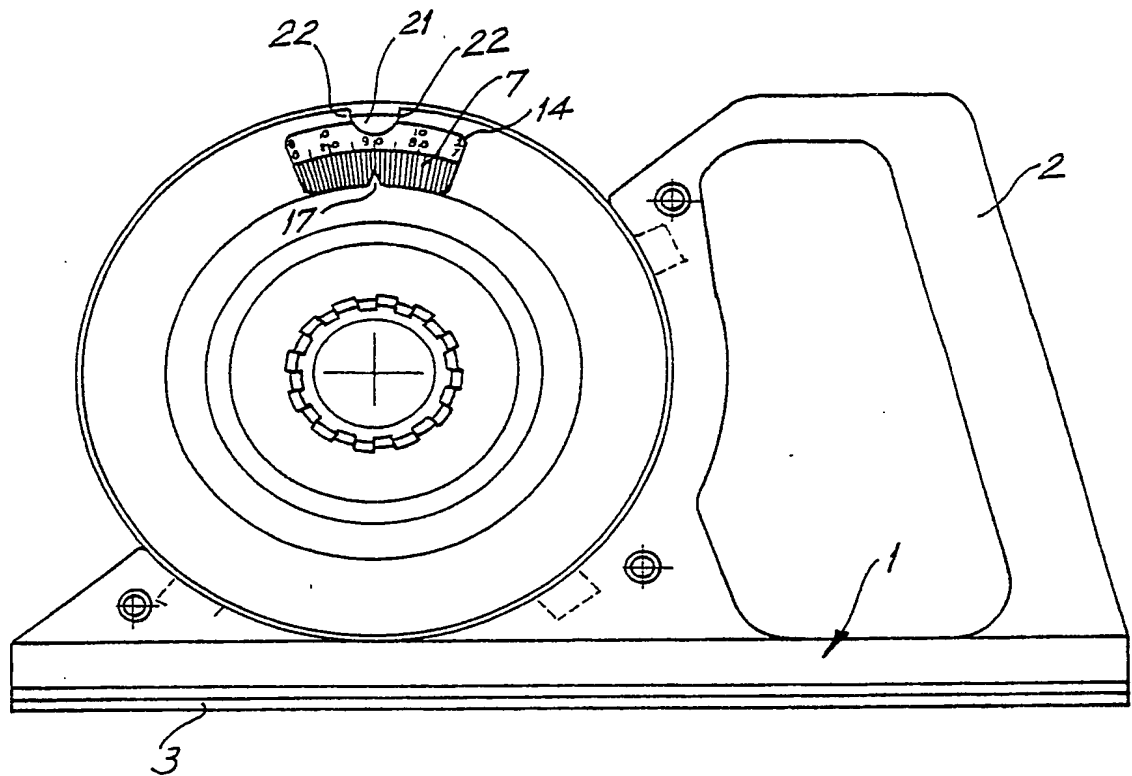


FIG. 5

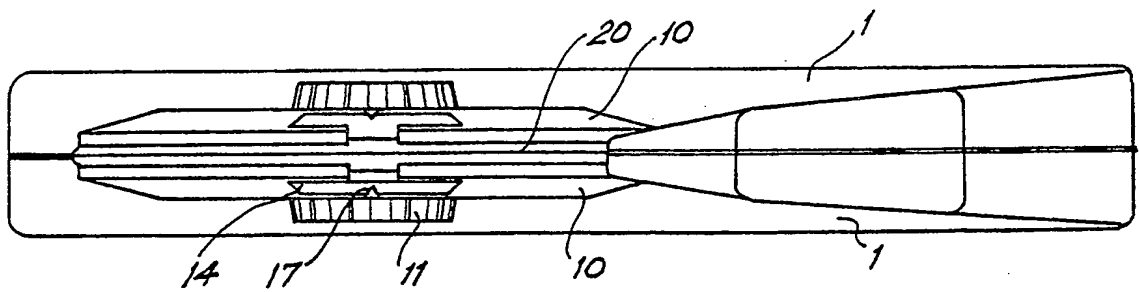


FIG. 6



## INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 84/00003

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl. <sup>3</sup> G01C 9/24, 9/26		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
IPC	G01C 9/24, 9/26	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched <sup>5</sup>		
AU: IPC as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
X	US, A, 3009250 (SCHOCK) 21 November 1961 (21.11.61)	(1)
X	GB, A, 538875 (WILLIAMS) 20 August 1941 (20.08.41)	(1)
X	FR, A, 1197262 (BRON) 30 November 1959 (30.11.59)	(1)
X	US, A, 1630172 (CUSTER) 24 May 1927 (24.05.27)	(6, 7)
X	US, A, 2287863 (BUCKLEY) 30 June 1942 (30.06.42)	(6-8)
X	US, A, 2469795 (SPROUL) 10 May 1949 (10.05.49)	(6-8)
X	US, A, 2805480 (SPARKS) 10 September 1957 (10.09.57)	(6-8)
X	US, A, 287 1573 (SCHENKER) 3 February 1959 (03.02.59)	(6-8)
X	US, A, 3673696 (WASSON) 4 July 1972 (04.07.72)	(6-8)
X	US, A, 3673697 (WASSON) 4 July 1972 (04.07.72)	(6-8)
X	GB, A, 446934 (LYONS) 8 May 1936 (08.05.36)	(6, 7)
(cont'd...)		
<p><sup>15</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>1</sup>	Date of Mailing of this International Search Report <sup>2</sup>	
28 March 1984 (28.03.84)	5 April 1984 (5-4-84)	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>19</sup>	
Australian Patent Office	A.S. Moore <i>A.A. Moore</i>	

## III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No <sup>18</sup>
A	US, A, 3208147 (ESTES) 28 September 1965 (28.09.65)	
A	FR, A, 960807 (AEGERTER) 26 April 1950 (26.04.50)	